What is claimed is:

SUB B1 1. A process for producing an optical wavelength converting device having a periodic domain inversion structure, in which a periodic electrode is formed on one surface of a single-polarized ferroelectric substance having nonlinear optical effects, and an electric field is applied across the ferroelectric substance by the utilization of the periodic electrode in order to set regions of the ferroelectric substance, which stand facing the periodic electrode, as local area limited domain inversion regions, the process comprising the steps of:

i) forming a photosensitive resist layer on the one surface of the ferroelectric substance, the resist layer having properties such that, when light is irradiated to the resist layer, only exposed areas of the resist layer or only unexposed areas of the resist layer become soluble in a developing solvent,

ii) exposing the resist layer to near field light in a periodic pattern with means, which receives exposure light and produces the near field light in the periodic pattern,

iii) developing the resist layer, which has been exposed to the near field light, to form a periodic pattern in the resist layer, and

iv) forming the periodic electrode on the one surface of the ferroelectric substance by utilizing the

periodic pattern of the resist layer as a mask, the periodic electrode being formed at positions corresponding to opening areas of the mask.

2. A process for producing an optical wavelength converting device having a periodic domain inversion structure, in which a periodic electrode is formed on one surface of a single-polarized ferroelectric substance having nonlinear optical effects, and an electric field is applied across the ferroelectric substance by the utilization of the periodic electrode in order to set regions of the ferroelectric substance, which stand facing the periodic electrode, as local area limited domain inversion regions, the process comprising the steps of:

i) forming an electrode material layer on the one surface of the ferroelectric substance,

ii) forming a photosensitive resist layer on the electrode material layer, the resist layer having properties such that, when light is irradiated to the resist layer, only exposed areas of the resist layer or only unexposed areas of the resist layer become soluble in a developing solvent,

iii) exposing the resist layer to near field light in a periodic pattern with means, which receives exposure light and produces the near field light in the periodic pattern,

iv) developing the resist layer, which has been exposed to the near field light, to form a periodic pattern

in the resist layer, and

v) etching the electrode material layer by utilizing the periodic pattern of the resist layer as an etching mask, such that portions of the electrode material layer at positions corresponding to opening areas of the mask are removed by the etching, whereby the periodic electrode is formed.

3. A process for producing an optical wavelength converting device having a periodic domain inversion structure, in which a periodic electrode is formed on one surface of a single-polarized ferroelectric substance having nonlinear optical effects, and an electric field is applied across the ferroelectric substance by the utilization of the periodic electrode in order to set regions of the ferroelectric substance, which stand facing the periodic electrode, as local area limited domain inversion regions, the process comprising the steps of:

i) forming a first resist layer and a second resist layer in this order on the one surface of the ferroelectric substance, the first resist layer being removable by etching, the second resist layer being photosensitive and having properties such that, when light is irradiated to the second resist layer, only exposed areas of the second resist layer or only unexposed areas of the second resist layer become soluble in a developing solvent,

ii) exposing the second resist layer to near field light in a periodic pattern with means, which receives exposure light and produces the near field light in the periodic pattern,

iii) developing the second resist layer, which has been exposed to the near field light, to form a periodic pattern in the second resist layer,

iv) etching the first resist layer by utilizing the periodic pattern of the second resist layer as an etching mask to form a periodic pattern composed of the first resist layer and the second resist layer, and

v) forming the periodic electrode on the one surface of the ferroelectric substance by utilizing the periodic pattern, which is composed of the first resist layer and the second resist layer, as a mask, the periodic electrode being formed at positions corresponding to opening areas of the mask.

4. A process for producing an optical wavelength converting device having a periodic domain inversion structure, in which a periodic electrode is formed on one surface of a single-polarized ferroelectric substance having nonlinear optical effects, and an electric field is applied across the ferroelectric substance by the utilization of the periodic electrode in order to set regions of the ferroelectric substance, which stand facing the periodic electrode, as local

area limited domain inversion regions, the process comprising the steps of:

i) forming an electrode material layer on the one surface of the ferroelectric substance,

ii) forming a first resist layer and a second resist layer in this order on the electrode material layer, the first resist layer being removable by etching, the second resist layer being photosensitive and having properties such that, when light is irradiated to the second resist layer, only exposed areas of the second resist layer or only unexposed areas of the second resist layer become soluble in a developing solvent,

iii) exposing the second resist layer to near field light in a periodic pattern with means, which receives exposure light and produces the near field light in the periodic pattern,

iv) developing the second resist layer, which has been exposed to the near field light, to form a periodic pattern in the second resist layer,

v) etching the first resist layer by utilizing the periodic pattern of the second resist layer as an etching mask to form a periodic pattern composed of the first resist layer and the second resist layer, and

vi) etching the electrode material layer by utilizing the periodic pattern, which is composed of the first

resist layer and the second resist layer, as an etching mask, such that portions of the electrode material layer at positions corresponding to opening areas of the mask are removed by the etching, whereby the periodic electrode is formed.

5. A process as defined in Claim 3 or 4 wherein the second resist layer has a film thickness of at most 100nm.

6. A process as defined in Claim 3 or 4 wherein the first resist layer is formed from a non-photosensitive material, and the etching performed for the first resist layer is dry etching.

7. A process as defined in Claim 1, 2, 3, or 4 wherein the exposure light has a wavelength falling within the range of 250nm to 450nm.

8. A process as defined in Claim 1, 2, 3, or 4 wherein the means, which receives the exposure light and produces the near field light in the periodic pattern, is a mask comprising a light-transmitting member, which is capable of transmitting the exposure light, and a metal pattern, which has opening areas and is formed on the light-transmitting member, the near field light being radiated out from the metal pattern, and

the mask comprising the light-transmitting member and the metal pattern is located such that the metal pattern is in close contact with the resist layer, which is laid bare on the ferroelectric substance, or the metal pattern is located

close to the resist layer, which is laid bare on the ferroelectric substance, such that the near field light reaches the resist layer, which is laid bare on the ferroelectric substance, the exposure light being irradiated to the mask comprising the light-transmitting member and the metal pattern in this state.

9. A process as defined in Claim 1, 2, 3, or 4 wherein the means, which receives the exposure light and produces the near field light in the periodic pattern, is an optical stamp constituted of a light-transmitting member, which is capable of transmitting the exposure light and has a concavity-convexity pattern formed on one surface, the optical stamp operating such that, when the exposure light is guided from within the light-transmitting member to the one surface of the light-transmitting member and is caused to undergo total reflection, the near field light in a pattern in accordance with the concavity-convexity pattern formed on the one surface of the light-transmitting member is radiated out, and

the optical stamp is located such that the one surface of the optical stamp provided with the concavity-convexity pattern is in close contact with the resist layer, which is laid bare on the ferroelectric substance, or the one surface of the optical stamp provided with the concavity-convexity pattern is located close to the resist layer, which

is laid bare on the ferroelectric substance, such that the near field light reaches the resist layer, which is laid bare on the ferroelectric substance, the exposure light being irradiated to the optical stamp in this state.

10. A process as defined in Claim 1, 2, 3, or 4 wherein the means, which receives the exposure light and produces the near field light in the periodic pattern, is a probe provided with an opening having a diameter shorter than a wavelength of the exposure light, the probe being caused to scan on the resist layer, which is laid bare on the ferroelectric substance, the exposure light being irradiated to the probe in this state.

11. A process as defined in Claim 1, 2, 3, or 4 wherein the ferroelectric substance is $LiNbO_3$ doped with MgO.

12. A process as defined in Claim 11 wherein the periodic electrode has an electrode line width of at most 0.3μm.

13. An optical wavelength converting device produced with a process as defined in Claim 1, 2, 3, or 4.

14. An optical wavelength converting device, comprising a crystal of a Z-cut plate of $LiNbO_3$ doped with MgO, domain inversion regions being formed periodically in a bulk form in the crystal,

wherein the domain inversion regions are formed with a period falling within the range of 1.0μm to 4.6μm.

15. An optical wavelength converting device, comprising a crystal of a Z-cut plate of $LiNbO_3$ doped with MgO, domain inversion regions being formed periodically in a bulk form in the crystal,

wherein the optical wavelength converting device is constituted to radiate out a wavelength-converted wave having a wavelength falling within the range of 320nm to 470nm.

16. An optical wavelength converting device, comprising a crystal of a Z-cut plate of $LiNbO_3$ doped with MgO, domain inversion regions being formed periodically in a bulk form in the crystal,

wherein the domain inversion regions are formed with a period falling within the range of 1.0μm to 4.6μm, and

the optical wavelength converting device is constituted such that, when a fundamental wave having a wavelength falling within the range of 640nm to 940nm impinges upon the optical wavelength converting device, the optical wavelength converting device radiates out a second harmonic having a wavelength falling within the range of 320nm to 470nm with the period of the domain inversion regions acting as a first-order period for pseudo-phase matching.

17. A solid laser, comprising an optical wavelength converting device as defined in Claim 13, the solid laser being constituted to covert a produced laser beam into its second harmonic and to radiate out the second harmonic.

18. A solid laser, comprising an optical wavelength converting device as defined in Claim 14, 15, or 16, the solid laser being constituted to covert a produced laser beam into its second harmonic and to radiate out the second harmonic.

Add a27